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Women Cotton Farmers
Their Perceptions and Experiences with Transgenic Varieties
A Case Study for Colombia

Patricia Zambrano

Jorge H. Maldonado

Sandra L. Mendoza

Lorena Ruiz

Luz Amparo Fonseca

Iván Cardona

Environment and Production Technology Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Patricia Zambrano, International Food Policy Research Institute
Senior Research Analyst, Environment and Production Technology Division
P.Zambrano@cgiar.org

Jorge H. Maldonado, Universidad de los Andes
Associate Professor, Department of Economics
jmaldona@uniandes.edu.co

Sandra L. Mendoza, Universidad de los Andes
Student, Master Program Sustainable Technology Kungliga Tekniska Högskolan
salumemo@yahoo.com

Lorena Ruiz, Confederación Colombiana del Algodón
Head, Economics Department
lorena.ruiz@conalgodon.com.co

Luz Amparo Fonseca, Confederación Colombiana del Algodón
Director
luz.fonseca@conalgodon.com.co

Iván Cardona, Institute of Development Studies
Research Assistant
ivancardona8@gmail.com

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ABSTRACT

This paper explores gender differences in cotton cultivation and looks into the perceptions and experiences of women and men with transgenic varieties. With few exceptions, researchers in the area of impact evaluation of crop biotechnology have only marginally included gender considerations in their work. This exploratory pilot study was developed in order to incorporate gender into our quantitative evaluation work. This study used a participatory and descriptive approach that allowed us to listen to women and men farmers' perceptions and insights. The project was conducted in the main cotton-producing regions of Colombia where a handful of transgenic varieties have been in the market for the past six years.

The participatory exercises developed by the team show that there are key gender differences that need to be addressed and studied. Despite the widespread perception among male cotton producers that women are not cotton farmers, this project shows that women participate in several operations of the crop and that there are in fact some women that successfully manage or share with their spouses cotton-production responsibilities.

Specific differences in perceptions of transgenic varieties between female and male farmers were also brought to the attention of the researchers. Female farmers managing their plots appeared to prefer insect-resistant varieties over conventional ones mainly because these transgenic varieties can reduce the number of male laborers that women would need to hire to spray pesticides, a task solely performed by men. Similarly, technologies that potentially reduce manual weeding, particularly if women and children in a household are the ones in charge of this backbreaking activity, can be especially attractive to women. The perceptions can be the opposite for women who are hired for weeding, as a reduction in hired labor might mean losing a source of income that may not be replaced. Both female and male farmers identified the lack of adequate and timely information as the main disadvantage of transgenic varieties; this problem disproportionately affected more female than male farmers. Female farmers appear to have more difficulty accessing or sharing information, due to time restrictions, particularly if they carry most or the entire burden of domestic responsibilities. At the same time, information that actually gets in the hands of farmers seems to be followed more judiciously by female farmers, a fact that potentially translates into better management of the technology. With some important exceptions, perceptions about transgenic cotton varieties appear to be positive for female and male farmers. The difference is the way female and male farmers spend the additional resources. Male farmers prefer to dispose of their profits in leisure activities, whereas female farmers devote their additional income to investing in their family's nutrition, education, and health.

All these perceptions demand further investigation. This study offers a first look at the potential of women farmers as productive cotton producers and successful users of new technologies.

Keywords: crop biotechnology, genetically modified crops, genetic engineering, cotton, Colombia, gender, perceptions

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ABBREVIATIONS AND ACRONYMS

Bt	*Bacillus thuringiensis*, a gene from the soil bacterium that confers resistance to a range of lepidopteran species
CONALGODÓN	Confederación Colombiana del Algodón
GM	genetically modified
HT	herbicide-tolerant
ICA	Instituto Colombiano Agropecuario
IFPRI	International Food Policy Research Institute
IR	insect-resistant
TA	technical assistant

1. INTRODUCTION

The impact of the adoption and use of transgenic seeds in developed and developing economies has been relatively well documented and researched. Literature reviews on the subject and specific findings are numerous. An overall review of this literature confirmed that, with some notable exceptions, research has paid little attention to exploring, understanding, or analyzing the differences among men and women as adopters and users of transgenic agricultural technology or the gender differences in access, perceptions, and attitudes regarding these technologies.

The literature on gender has shown that addressing these differences can be "one of the most effective, efficient, and empowering ways to boost development and address poverty" (Meinzen-Dick et al. 2010, 1). As opposed to biological differences between male and females, "gender differences arise from the socially constructed relationship between men and women and are context and cultural specific" (Quisumbing and McClafferty 2006, 1). Gender differences can affect basic human rights, and also result in unequal access to and use of the technology, which has welfare outcomes (Meinzen-Dick et al. 2010). In the specific case of transgenic seeds that are relatively more expensive and require additional information, women can be in a less advantageous position as access to financial and land resources as well as extension services can be, in comparison with men, more limiting factors. On the other hand, some transgenic crops can be seen, for cultural reasons, as particularly beneficial to female farmers for the specific characteristic of the technology, as could be the case of herbicide-tolerant (HT) crops that result in a weed-control system that is less labor intensive. Identifying and addressing these differences can boost the economic and social benefits of these technologies.

This paper presents results of a research project that explores some of these gender issues. The approach taken for this research was an exploratory one, focused on learning from female and male farmers' perceptions and opinions. Qualitative instruments were developed to facilitate farmers and other stakeholders' discussion and opinions regarding the participation of women and men in the cotton operation and their perceptions and opinion regarding the use of conventional and transgenic varieties. The work was conducted in the main cotton-producing regions of Colombia where a handful of transgenic varieties have been in the market for the past years. A previous study about the impact of *Bacillus thuringiensis* (Bt) cotton in Colombia carried out by the IFPRI-CONALGODÓN[1] team in 2007–08 suggested that gender might be an interesting factor to consider. Fieldwork for that study showed that the widespread opinion that women, aside from harvesting, were not involved in cotton production was not entirely true. That same fieldwork confirmed that women were involved in other cotton operations, and more surprising found a few women responsible for the overall production of cotton.

The first objective of this study was to learn from a select group of farmers and other stakeholders what role, if any, gender had played in the access to, adoption of, and use of genetically modified (GM) cotton in Colombia. Another objective was to develop a qualitative methodology that facilitated the active, lively, and equal participation and discussion of male and female participants that could be adapted and implement in other countries. The final objective was to identify specific gender-related issues to further explore in ongoing quantitative assessment of GM crops.

The paper is organized as follows: In the section that follows background information is given about cotton production in Colombia and the use of transgenic varieties in the country. In the third section, a summary is presented of the gender-related variables identified in the IFPRI-CONALGODÓN 2007–08 survey. In the fourth section an overall review of the literature on GM technology and gender is offered. In the fifth section, an outline of the objectives of this project and a summary of the methodology as well as the instruments developed and used is presented. In the sixth section, the results of the surveys, interviews, and focus groups that were implemented are detailed. In the seventh section an assessment of all logistical and methodological limitations that were encountered in the implementation of this project is provided. The paper concludes with a summary of the main findings and draws some final conclusions.

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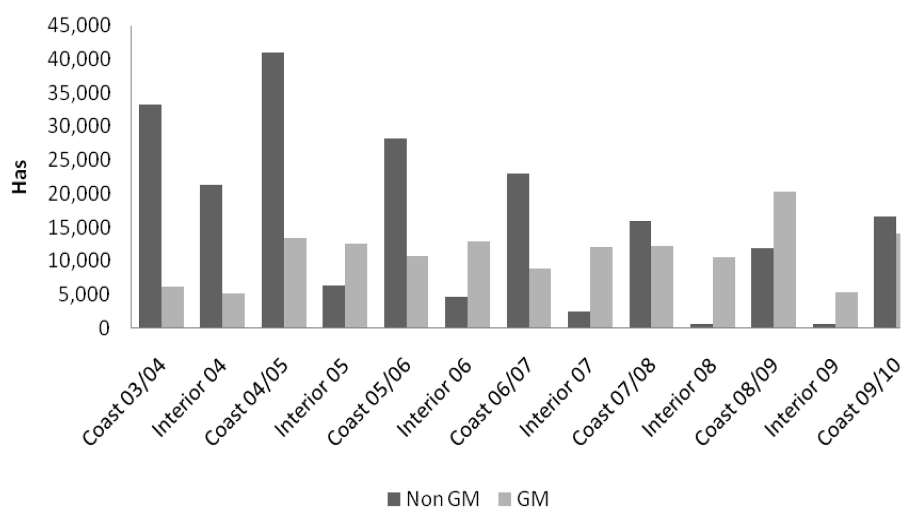
[1] CONALGODÓN is a non-for-profit organization funded in 1980 that represents Colombian cotton farmers. Its mission is to improve competitiveness and attain sustainable conditions for the international and national production and commercialization of cotton seed and fiber. See http://www.conalgodon.com/portal/index.php?option=com_content&task=view&id=12&Itemid=28.

2. BACKGROUND

Colombia has two main cotton-producing areas with distinct characteristics and planting seasons. The main region is located in the Caribbean coastal region of the country, where cotton farmers have limited access to irrigation and machinery and, relative to the interior region, have a higher concentration of both larger and smaller cotton farms. The second region, in the interior part of the country where 40 percent of the cotton is produced, has a more commercialized agriculture with access to irrigation. A 2007–08 IFPRI-CONALGODÓN study of the economic impact of Bt cotton (Zambrano et al. 2009), based on a sample of 364 farmers, concluded that cotton producers from the interior region, where the technology was widespread, had benefited from the adoption of Bt cotton. Evidence on the benefits of Bt cotton in the coastal region was inconclusive. The adoption of Bt technology in this region was more limited as the main pest was, and continues to be, boll weevil rather than bollworms—the Bt-targeted pest.

The cotton situation in Colombia has also evolved since the original IFPRI-CONALGODÓN study was undertaken. At the time of that study the only commercialized variety was a single Bt variety, known in Colombia as Nuopal, a variety imported, introduced, and commercialized in Colombia by Monsanto Company or its local representatives. After 2008, other genetically modified (GM) varieties came onto the market and Nuopal is now a variety rarely planted in Colombia, probably because Monsanto limited its availability in favor of newer varieties. In addition, one of the herbicide-tolerant (HT) varieties introduced in 2008–09 appeared not to have had favorable results for farmers and in some cases translated in large yield and revenue losses. Whether these losses were attributable to the type of GM trait, germplasm, poor agronomic practices, or weather variability remains to be proven. Farmers appear to be more optimistic about other stacked (insect-resistant [IR], HT) varieties; however, the percentages of areas planted with GM varieties and the extent of cotton area has declined since the 2007–08 seasons as can be seen in Figure 2.1.

Figure 2.1—Colombia: Area planted to GM and Non-GM varieties, 2004–2009



Source: CONALGODÓN, personal communication 2010.

3. GENDER FINDINGS OF 2007–2008 STUDY AND DEVELOPMENT OF RESEARCH QUESTIONS

Some preliminary analysis of the IFPRI-CONALGODÓN 2007–08 survey responses suggested that women had a more active role in the production of cotton than what was initially assessed. The 2007–08 sample drawn for the survey was not gender stratified, but the survey was designed to elicit some gender-disaggregated data, particularly with regard to hired labor by operation. Women have traditionally been hired for harvesting, and the survey confirmed that most female laborers were hired for this activity. However, this survey found a few women involved in less traditional roles, such as weeding and fertilizing activities. Table 3.1 lists the number of hired and family farm laborers used in the different operations of cotton production—from land preparation to stalk destruction. This table shows the extent of female participation in the different steps of the production process and also shows that the total number of female laborers is less for Bt cotton plots than for conventional ones.

Table 3.1—Number of male and female daily laborers, by operation

	Conventional				Bt			
	Male	Female	Family member	Total	Male	Female	Family member	Total
Total—day laborers (number per hectare)	161.2	10.7	14.2	186.1	174.2	6.9	3.1	184.1
Tillage	4.6	-	-	4.6	6.4	-	-	6.4
Planting	14.6	0.0	0.9	15.5	14.2	0.3	0.2	14.7
Irrigation	10.9	-	0.1	11.0	4.2	-	0.0	4.3
Weeding	39.6	0.3	5.7	45.6	32.7	0.8	1.3	34.8
Soil fertilization	10.0	0.2	1.5	11.7	12.7	0.2	0.5	13.4
Pest control	14.3	0.1	2.9	17.3	17.3	0.1	0.6	18.0
Disease control	1.5	-	0.1	1.7	2.1	-	0.0	2.1
Growth regulators and preharvest	2.1	0.0	0.2	2.3	3.1	0.1	0.0	3.2
Harvesting	58.8	9.8	1.6	70.1	75.7	5.2	0.1	81.0
Stalk destruction	4.9	0.3	1.1	6.3	5.8	0.2	0.2	6.2

Source: IFPRI-CONALGODÓN 2007–08 survey.

The number of women-headed plots in the 2007–08 sample was only 2 percent of the total, but interviews with those women suggested they had a more open attitude toward Bt cotton than men. These female farmers appeared more willing to adopt the new practices that the technology required and also perceived the benefits of the technology as a way to save labor (that is, hiring less male labor), a particularly important benefit to women who managed their own plots. These findings were more apparent from the fieldwork and interaction with farmers than from the formal survey.

Table 3.2 summarizes all gender-disaggregated household variables from the 2007–2008 survey. The number of years of education for both female and male members is significantly higher in households that plant Bt cotton than in those planting conventional varieties. Females from households that plant transgenic plots have more years of education than their male counterparts in two of the three cotton regions.

Table 3.2—Household data: Male and female household members

Variable	Tolima 2007		Córdoba 2007–08		Sucre 2007–08	
	Conv.	Bt	Conv.	Bt	Conv.	Bt
Education (number of years, average)						
Male	5.7 *	8.1*	8.2*	10.4*	5.0*	5.1*
Female	6.0*	8.8*	8.0**	9.8*	4.1*	5.9*
Household members (%)						
Male	49.7	51.2	52.5	53.0	57.8	54.1
Females	50.3	48.8	47.2	47.0	42.2	45.9
Women who work on farm (%)						
Full-time	8.5	18.3	7.6 ***	2.7 ***	3.3	8.2
Occasionally	23.9	14.4	19.4 ***	10.7 ***	11.0	13.7
Do not work	67.6	67.3	72.9 ***	86.7 ***	85.7	78.1
Women who work off farm (%)						
Full-time	7.0	9.6	19.4	30.7	3.3	5.5
Occasionally	5.6	7.7	19.4	13.3	12.1	15.1
Do not work	87.3	82.7	61.1	56.0	84.6	79.5

Source: IFPRI-CONALGODÓN 2007–2008 survey.
Note: *, **, *** = statistically significant at 1, 5, and 10%, respectively.

Another characteristic of women in households that plant transgenic cotton is that they appear to work outside the farm more than women in households that plant conventional varieties. Although not a conclusive difference between these households, these data suggest there were differences in education and female labor participation between households planting conventional cotton and those planting transgenic varieties. Aside from the limited formal survey data collected, fieldwork for the 2007–2008 survey suggested there were differences between men's and women's perceptions of and attitudes toward Bt cotton. The significance of these differences in perceptions and attitudes having any influence on the actual adoption of Bt varieties was not investigated, but the fieldwork finding pointed to the need to better understand gender-related factors influencing adoption and use of transgenic varieties.

Existing literature on the economic impacts of transgenic crops has only touched on these subjects, but gender aspects are starting to be taken into account. The next section reviews the few examples from the literature on the economic impacts of GM crops in developing countries that have looked at gender and summarizes their main gender-related findings.

4. GENDER AND THE LITERATURE ON THE ADOPTION OF GM TECHNOLOGY

The literature on technology adoption has explored the differences between men and women in technology uptake and, in particular, varietal-trait preferences. Quisumbing (1995) points out that woman farmers' slower adoption of technologies is related to their limited access to education and physical assets. Doss and Morris (2001) document that in Ghana decisions to adopt modern maize varieties and fertilizers are gender differentiated, strictly because women have (in comparison to men) limited access to complimentary assets such as land, labor, and extension services. Quisumbing and Pandolfelli (2010) summarize findings of Bourdillon et al. (2007) for Zimbabwe and Hallman, Lewis, and Begum (2007) for Bangladesh on how women's limited access to financial resources, land assets, and formal extension services constrain their technology choices. Peterman, Behrman, and Quisumbing (2010) did a literature review on gender and access to nonland assets of 24 household or plot microeconomic studies. They point out that gender differences in crop choices and division of labor differ according to region and cultural backgrounds. Specifically for seed, aside from what Doss and Morris (2001) already documented, they cite Tiruneh et al.'s (2001) study in Ethiopia that analyzes how there is a significantly higher number of male-headed households compared to female-headed households that use improved wheat seeds. A similar result for Nigeria is cited in Sanginga et al. (2007), with less female farmers using improved soybeans. At the same time, Horrell and Krishnan (2007), as cited by Peterman, Behrman, and Quisumbing (2009), found that usage and yields of maize were not significantly different among female and male head of households. This result is replicated in Chirwa (2005) and Bourdillon et al. (2002) in Malawi and Zimbabwe.

Meinzen-Dick et al. (2010) document the reasons for differential adoption rates of new technologies between male and female farmers. Aside from the studies already cited, Meinzen-Dick et al. (2010) refer to studies by Tiruneh et al. (2001) in Ethiopia; Gilbert, Sakala, and Benson (2002) in Malawi; and Kinkingninhoun-Mêdagbé et al. (2008) in Benin. Their recommendation is to develop new technologies that address specific female needs and identify and target specific constraints that women face in the adoption of these technologies in order to improve the adoption of these new varieties and technologies.

Social norms and traditional gender roles also influence the difference in variety preferences of women versus those of men. If women are responsible for food preparation, their variety preferences may favor those considered nutritionally or traditionally superior for their families. In Uganda, for example, women tend to prefer banana cultivars destined for consumption, whereas men favor hybrids that can be used for beer brewing and sale (Edmeades et al. 2007). The type of technology and farmers' access to resources will determine how successfully or asymmetrically new technologies are adopted by both men and women (Padmaja et al. 2006). The gender impacts of technology adoption depend "on intricate webs of interaction that defy simple generalizations" (Doss 1999, 1), as every country and community has a set of formal and informal institutions and defined and changing gender roles and responsibilities.

The general literature on the impact of GM crops in developing economies contains few references to literature on gender-related aspects of technology adoption. Reviewing the relatively large peer-reviewed literature on the economic impact of GM crops in developing countries (see bEcon http://www.ifpri.org/book-637/ourwork/program/genetic-resource-policies-poor/becon), few papers were found that analyze, or even mention, gender-differentiated impacts. One paper that makes reference to gender impacts is an early article by Bennett et al. (2003) for Bt cotton in the Makhathini Flats in South Africa. The authors focus their attention on the beneficial aspects of the technology and mention in their analysis how the observed reduction in the number of sprays would free up time for women, with subsequent benefits for the family. Bennett et al. (2003) base their conclusions on a relatively small, but detailed, sample of interviews of 32 households, 60 percent of which were headed by women. Bennett et al. (2003, 126) note that an "equal number of men and women do the spraying" but that the day's labor saved is more important to women given their many household responsibilities. Data about perceptions of Bt cotton in Bennett et al. (2003) are unfortunately not separated by gender, but they do mention that small-scale farmers (mostly women) grow Bt cotton because it is a labor-saving technology. In a later article using the same data from those 32 households, Bennett, Morse, and Ismael (2006) state that Bt cotton benefits women and children as it saves them time and effort that otherwise would be needed to invest in collecting water for spraying insecticides. The authors report that the sample of 32 households is representative of 1,400 small-scale farm households in the region, 60 percent of which are female headed. Apparently most of them are de facto household heads due to the high rate of male migration from the area. Thirtle et al. (2003) document that during the first planting season of Bt cotton in the Makhathini Flats most farmers who were offered Bt seed were men. In the second season, after seeing the success of the technology, women were more active in securing the seed so they could plant it. Unfortunately, and despite that 42 percent of households surveyed by Thirtle et al. (2003) are female headed, the authors make only one additional indirect mention on the differences in adoption rates between men and women. Compared to nonadopters, first-year adopters, mainly men, have fewer female and male laborers per hectare. Second-year adopters, a good proportion of them females, have the least number of male laborers but the most female laborers per hectare (Thirtle et al. 2003). In a later article, Morse, Bennett, and Ismael (2006) use company records from Vunisa Cotton of Makhathini Flats for the first three years of adoption; they show that the majority of adopters are women, but there is no exploration of the possible differences between male and female adoption rates as all data are aggregated.

Subramanian and Qaim (2009, 2010) present one of the more interesting conclusions related to the gender-differentiated impacts of Bt cotton. Based on a micro social accounting matrix (SAM), Subramanian and Qaim are able to capture the gender-differentiated labor market and income effects of Bt cotton. The SAM was constructed based on a detailed census of Kanzara Village in Maharashtra, the state with the largest cotton area in India. Cultivation of Bt cotton yields increase as the number of female laborers participating in the production of cotton, mainly as workers hired for sowing, weeding, and harvesting operations, increases. In contrast, the expected reduction in the number of insecticide applications translates into less male family labor, since pesticide application is done primarily by male family members. A particularly interesting conclusion from Subramanian and Qaim (2009, 2010) is in regard to income, which favors males as they can use their free time in more productive (income-earning) activities outside the farm, activities that are not open to women laborers.

The few authors that have researched gender differences have pinpointed important aspects, but have stopped short of incorporating their findings into their analyses. No intrahousehold analysis was undertaken; thus, any quantitative analysis of gender differences is extremely limited. At most, analysis is limited to the use of gender dummies in econometric analysis; however, in the majority of cases, the words *gender*, *female*, or *woman* are not mentioned.

5. METHODOLOGY AND INSTRUMENTS USED

Using both the information collected from the IFPRI-CONALGODÓN 2007–08 survey and the literature on the gender impacts in technology adoption reviewed above, an initial set of research hypotheses and questions to be addressed using a qualitative approach was developed. The purpose of this qualitative study is to better characterize issues and to formulate a more complete set of research questions that can be used in a future quantitative analysis. The aim was also to develop an appropriate research methodology for broader application in more comprehensive studies on gender and biotechnology.

The instruments proposed were interviews or focus groups or both with cotton producer's association managers, technical assistants (TAs), and both women and men farmers, the main stakeholders in the adoption and dissemination and use of GM cotton. These approaches were to be applied in Cereté and El Espinal, the two main cotton-production municipalities in Colombia. The selected group of stakeholders had already been identified in the IFPRI-CONALGODÓN 2007–08 work and also by local partners. Before proceeding with the design and conducting of the interviews and focus group discussions, the individual farmers to be invited to the focus groups were identified. The next section describes this process in detail.

Sample Design for Main Cotton-Production Municipalities

The first step in the fieldwork was the selection of workshop and focus group participants for the two selected municipalities in the main cotton-production regions of Colombia. The stakeholder groups identified were not only female and male cotton farmers, but also TAs and regional cotton association managers. Female and male farmers, planting either transgenic or conventional varieties, were the first group identified. TAs were also targeted as they play an active role in the cotton-production process in Colombia (Zambrano et al. 2009). Although no longer required by law, every farmer seeking subsidized credit from a regional association had to have a TA. Since the regional associations extend credit lines to their affiliates but are financially responsible for credit repayment, associations rely on TAs' visits and advice to farmers as ways to ensure that the plots of their affiliates are well managed and that farmers will have a production to repay the association. TAs are also targeted by technology developers and chemical industry representatives to provide information about and promote their products to farmers. The other stakeholders that play an important role in the use of GM seed in Colombia are the managers of the regional associations, as the association acts as a financial intermediary and provider of agricultural inputs and services.

In Colombia all cotton producers have to register their plots with a local association. This registry was used to select the group of cotton farmers for this study. Access to this complete list of plots was a tremendous contribution to the sample selection.

Because of phytosanitary regulations, all cotton farmers, who have the intention to plant cotton, are required to register their plots with the national regulatory agency, the Colombian Agrarian Institute, Instituto Colombiano Agropecuario (ICA). The responsibility for implementing registration was assigned by ICA to the local region associations. Cotton farmers are free to choose affiliation with a particular association, but all have to register their plots so ICA can maintain a complete list of plots. This aids in monitoring and controlling for stalk destruction at the end of the cotton season. The associations cooperate in this process as it is to their advantage to have such lists for planning purposes in their role as credit and input intermediaries. In 2004, the government established mechanisms for the establishment of an *association-managed* credit line targeting smallholders, with more favorable financial conditions than credit from a regular bank. Under this scheme, regional associations act as financial intermediaries for this type of credit line, backed up by their own assets, thus providing credit access to individual smallholder farmers who otherwise would find it unaffordable. The association in turn benefits as an input intermediary since farmers have to use their credit to purchase products and services provided by the association.

To select farmers for participation in the focus groups the 2009–10 ICA/Associations lists or registry was used. Given limitations in the project budget, the scope of work for this case study was limited to the main cotton-producing municipality of each of the two main cotton regions in Colombia: Cereté for the coastal region and El Espinal for the interior region. Although there are 96 cotton-producing municipalities in Colombia, Cereté and El Espinal account for around 22 percent of the total cotton area and production. The ICA plot registry contains the name and ID of the producer, plot area, location, GIS coordinates for the plot, variety used, the name of the TA, as well as the name of the local association under which each plot is registered.

A count of the number of women farmers in the ICA lists for El Espinal and Cereté showed that at least 30 percent of plots were registered to women—a surprisingly large number of women cotton farmers. The 2007–08 survey had not captured such an extensive role; only 2 percent of the 364 farmers surveyed during the 2007–08 season were women.

To be able to draw a sample of conventional and GM women farmers, the first task was to identify all women in ICA lists for Cereté and El Espinal and verify which of those women listed were in fact managing the plots registered under their names. Since, in most cases, the ICA registry records the TA of each farmer, CONALGODÓN regional coordinators were able to contact them and verify if indeed those women listed were managing the plots. Table 5.1 shows the results of this exercise.

Table 5.1—Number of registered and verified male and female cotton farmers

Variety planted	El Espinal					Cereté				
	All	ICA registry		Actual farmers		All	ICA registry		Actual farmers	
		Men	Women	Men	Women		Men	Women	Men	Women
Conv.	62	58	4	62	0	973	882	91	911	62
Trans.	160	124	36	145	15	107	88	19	100	7
Total	222	182	40	207	15	1,080	970	110	1,011	69

Source: ICA registry 2009/10 and verification from authors.
Note: Conv.: conventional; Trans.: transgenic.

Although it was expected that some women listed in ICA registry records would not be responsible for production, these results showed that a large share of registered female producers were not the actual farmers.

TAs and other stakeholders have their own hypothesis to explain this high proportion of registered but not actual female cotton farmers. According to them, it is a common practice for women to register plots under their names even though their husbands or other male family members will manage the plot. This is done for several reasons, but it seems the predominant one is that men have defaulted in their payments with the association in previous seasons, so they are unable to access the credit lines offered due to their bad credit standing. Since women usually have good credit standing, the men who had previously defaulted are able to gain access to these resources. Another reason for registering a male-headed plot under a woman's name is that it is easier for men to have their wives' names in the credit paperwork, since the only person authorized to request and receive inputs and services offered by the association is the credit signatory. That person has to physically go to the association and sign for those inputs, thus losing hours or even a day's work on the farm. Of course, there are other mechanisms that men could use, such as a certified authorization, but those would require notarization certificates that are cumbersome and require additional processing time. Because women are delegated to perform these tasks, women are involved in the cotton-production process. The extent to which they have decision power regarding the management of the credit they obtained and the overall management of the crop is yet to be studied. Some of the cotton association managers' perceptions are that women are more cautious in managing their credit lines and will tend to demand resources more conservatively than their male counterparts. Nevertheless, the perception is also that women have limited access to these credit lines as they tend to have fewer assets to back up their credit application and often need the assistance of a willing cosigner.

Based on the final list drawn from the verified women farmers in Table 5.1, a group of 15 women were selected for each region. For the Espinal workshop area invitations were sent to 10 women who planted transgenic cotton in El Espinal area and 5 who planted conventional cotton in areas close to El Espinal. For Cereté, where adoption of GM cotton is much lower, 8 women were invited who planted conventional and all 7 women who planted cotton in this area. The regional CONALGODÓN supervisor contacted each of these women in advance to verify their participation in the workshop planned for mid-December. This was the best season for both regions, as this is the one time of the year when farmers are not so busy in either region. Despite the advance notice and providing transportation for all participants (as well as lunch and snacks) only 8 of the 15 invited women were able to attend in El Espinal and 10 of the 15 invited in Cereté. The number of women cotton farmers that participated in this study is low because the number of women planting cotton in Colombia is still relatively low. These are women who for different reasons have taken what is perceived as a traditional male activity and shown that it is possible for them to independently plant and supervise a plot. It is a group of women who are quite vocal and have the potential to change the perceptions and traditions because they have been successful as cotton farmers. How representative they are of other women farmers is not the scope of this study; the objective was to explore their perceptions and attitudes toward GM cotton and learn from their insights for further quantitative and qualitative research.

The selection of TAs was a much easier process as the regional coordinators that CONALGODÓN have in the area know most of these agents and have professional and personal relations with them. Although there were more invitations accepted than assistants to the workshop, the number of TAs that worked with the researchers in these workshops was acceptable, particularly for Cereté.

In a similar way, CONALGODÓN regional coordinators were also able to secure personal interviews with managers of local cotton associations in El Espinal and Cereté.

Methodology

One of the main objectives of this project was to start to explore the gender dimensions of GM cotton using a participatory and descriptive approach that would allow researchers to listen to women and men farmers' perceptions and insights. Rather than the researcher having some specific hypothesis to test, the study looked for new hypotheses and issues that eventually we could incorporate, if possible, into the quantitative work. It is a difficult task because whereas quantitative researchers seek to validate perceptions with fieldwork and models, qualitative researchers want to understand a specific reality by listening and observing people in the community.

Participatory observation, interview, focal groups, and textual and documentary instruments are some of the techniques used in qualitative methods. The depth and time devoted to each of these instruments can vary widely. Given time and resource restrictions, the selected instruments used were limited to interviews and group techniques applied during a two-day period. The interviews were one-on-one, as opposed to a group, and were semi-structured as a specific set of questions was previously designed. Basically, two types of group techniques were used. The first was focal groups. The second was smaller group discussions. These techniques were designed to stimulate everyone's participation, open debate, and discussion (Iñiguez Rueda 1999). For a detailed description of the methodology and results of the workshop, see the Maldonado et al. (2010) report. The instruments were developed with participation of IFPRI and particularly CONALGODÓN, given their expertise with cotton. The instruments were implemented in a two-day workshop convened with the farmers, TAs, and association directors in December 2009.

Aside from this meeting convened in Cereté and El Espinal in December 2009, two preparatory meetings with farmers and other stakeholders were organized during the duration of this project.

The December meeting was convened once the instruments were designed and pretested, as well as revised by CONALGODÓN. The number of farmers that participated was 35 21 for Cereté and 14 for El Espinal. Table 5.2 lists the number of farmers as well as the activities and groups.

Table 5.2—Activities developed with farmers in Cereté and El Espinal

Activity	Description	Location	Type of group	No. of participants by group: All	Conv. Fem.	GM Fem.	Conv. Male	GM Male
Focus group	Map of cotton activities	Cereté	Plenary session	25				
		El Espinal		14				
	Variety preferences matrix	Cereté	Four groups	2	6	4	7	4
	Priority action matrix	El Espinal			3	5	3	3
Interviews	One-on-one, semi-structured	Cereté	Individual	7	1	3	2	2
		El Espinal		6		3	1	1
	Farm map	Cereté		7	1	3	2	2
		El Espinal		6		3	1	1
Surveys	One-page quantitative survey	Cereté	Individual	21	6	4	7	4
		El Espinal		14	3	5	3	3

Source: Authors' compilation.
Notes: "Conv. Fem.": women who plant conventional cotton; "GM Fem.": women who plant GM cotton varieties; "Conv. Male": men who plant conventional cotton; "GM Male": men who plant GM cotton varieties.

The main activity planned for this fieldwork was the plenary focus groups with the participation of all farmers. What was expected to be capture with this activity was the actual tasks and responsibilities performed by men and women before planting, during the cropping season, and after the crop is harvested. Different activities in every operation of the production process, from the decision to plant and secure a plot, if renting, to receipt of the final payment from the association at the end of the season were observed. Farmers' opinions were needed about the specific operations in which women participated, what was their role, and if there were differences between transgenic and conventional operations among women who managed transgenic plots and those who managed conventional plots. The format for this exercise was developed using the detailed cost by operation and activity that CONALGODÓN has developed to collect their annual cost data and was also used in the IFPRI-CONALGODÓN 2007–08 survey. The number of activities listed from the CONALGODÓN Cost of Production format was around 30, but with feedback from farmers the number grew to 34 in El Espinal and 45 in Cereté.

For the second activity participants were split into four groups according to gender (M/F) and variety planted (Conventional/GM) and each group was asked to rank the varieties according to some specific criteria shown in a matrix that was called the "variety preference matrix." Table 5.3 shows the matrix as it was presented to the four differentiated groups.

Table 5.3—Variety preference matrix

Criteria	Varieties: Conventional	Bt Insect-resistant	Herbicide-resistant	Bt and –Herbacide-tolerant
Costs	10 beans			
Daily wages	10 beans			
Time spent	10 beans			
Field yields	10 beans			
Fiber quality	10 beans			
Profits	10 beans			
What variety do you prefer?	(select one)			

Source: Authors' compilation.
Notes: Bt: Bacillus thuringiensis.

The procedure had farmers compare nonconventional varieties against a preassigned value given to conventional varieties. Each criterion for conventional had a value of 10 beans and each participant was given a set of beans to rank each of the criterion for the varieties listed. With a blank showing just the labels seen in Table 5.3, the facilitator would first place 10 beans for costs under the column corresponding to conventional variety. The facilitator would then ask the participants that if this were the value of costs for conventional, what value would they put under Bt. Once there was an assigned value the facilitator would move to the next variety and eventually to the next criterion until completing the whole matrix. This exercise required consensus and discussion among farmers and also allowed for re-evaluation as the discussion moved across and down the matrix. One interesting point of this exercise is that the facilitator never asked if the varieties were better or worse, but just solicited the opinions of all participants. This activity, as all others, was recorded after obtaining previous consent from farmers and participants. The tapes allowed for review of participants' exact words as well as pinpointing potential problems in the dynamics of the exercise.

The last group activity for the four defined groups was the "Priority Action Matrix" presented in two parts. The first part was a table that had just two columns with the following two related questions:

- What problems are there associated to this technological change?
- What is required to solve this problem?

The facilitator asked each participant to write his or her identified problem and the facilitator would transcribe their answers into the matrix. Once each participant had identified a problem the facilitator proceeded to solicit from the participants what would be required to solve the identified problem. Despite the facilitator asking the participants to write down their individual answers, in most cases the participants opted to do this as a team exercise.

After this exercise was completed the second step was to ask the participants to give details about the requirements to solve the specified problem. Lastly, the participants were asked to prioritize these problems using beans that were given to them. Again, this required discussion to reach a consensus among the participants without any intervention from the facilitator.

The final exercise was to complete an individual interview with selected participants identified from the plenary and group sessions. The selection criteria were based on the researchers' perceived knowledge of each farmer and their potential contribution to the identification of issues.

These interviews were semi-structured in the sense that they included 25 questions previously selected, which were designed to allow for the participant to expand and elaborate on points that were of interest to her or him. This was the opportunity to solicit information without group pressure and enable response comparison among participants to those 25 questions.

The interview ended with a graphic exercise, where the interviewer asked the farmer to draw his farm/plot, detailing the location of the house (if applicable), water sources, the location of cotton or any other crop, animals or other economic activity on farm, with roads and water sources in or around the farm. After drawing this map, the participant was asked to specify who worked in each of these places. The participant would put a red sticker to specify where women worked, a blue sticker for the places where men worked, and a yellow sticker for children. Seeing these stickers for each drawing was illustrative not only for the researcher, but also for the farmer, who, regardless of gender, was often surprised to see the participation of women around the farm.

The afternoon sessions of fieldwork in each of the locations was devoted to focus groups and interviews with TAs, as well as interviews with managers of local associations. The plan was to invite both male and female TAs to the workshop with the purpose of determining if their perceptions and attitudes would differ. Unfortunately, almost all TAs that showed up were male. Only one female TA in the Cereté region was successfully invited. In Colombia, technical assistance is given by agronomists and although currently at least one-third of college graduates are females (Universidad Nacional de Colombia 2009), only a small proportion of females appear to work as TAs. Table 5.4 summarizes the activities developed with all TAs, broken down by location and type of instrument used.

Table 5.4—Activities developed with technical assistants (TAs) and managers in Cereté and El Espinal

Participant	Instrument	Description	Location	TAs Male	TAs Female
TAs	Focus group	Information flow matrix from GM seed developer/distributor to TA	Cereté	11	1
			El Espinal	4	0
		Information flow matrix from TA to farmers	Cereté	11	1
			El Espinal	4	0
	Interviews	One-on-one, semi-structured	Cereté	10	1
			El Espinal	4	0
Association Managers	Interviews	One-on-one, semi-structured	Cereté	2	1
			El Espinal	3	0

Source: Authors' compilation.

The Information flow matrix between TAs and GM seed developer/distributor was based on a relatively simple matrix, where the TAs would detail the media, frequency, and content of the information they received from the seed developer or distributor. Initially this information was to be collected by variety, but the exercise showed that it was difficult to separate this information. Since there was supposed to be some kind of consensus for each of these points, TAs were immersed in a heated debate about the attitude and practices of the seed developers or distributors or both.

The second exercise with the TAs was the information flow matrix between the TAs and farmers. Here the aim was to collect the information that the TA gave to male and female farmers by crop operation. The information asked was detailed by time devoted to each activity, the media used, and their opinion regarding farmers' adoption of the advice that TAs provided. Table 5.5 presents reproductions of this matrix. To respond to the first question each TA had 100 beans to distribute among all of the 11 operations. The second question was written on note cards by each TA. The last question was responded to in terms of percentages—100 percent in cases when their advice was fully taken and 0 percent when it was not taken at all.

Table 5.5—Information flow matrix between TAs and farmers

Crop operation	How much time do you assist farmers in _____?	What media do you use to give advice _____?	How much do men/women follow your advice regarding ____? Male	Female
1. How much seed to plant per hectare				
2. Seed selection				
3. Planting				
4. Fertilizer selection and application				
5. Weed control				
6. Leaf fertilizer selection and application				
7. Insecticide selection and application				
8. Disease management				
9. Growing regulators and preharvest activities				
10. Assistance during harvest				
11. Stalk destruction				

Source: Authors' compilation

The last activity with TAs was a detailed one-on-one interview to collect each participant's opinion about possible differences or lack of them in the technical assistance provided to men versus that provided to women as well as their perceptions regarding the role of women in the decision to plant, access to credit, and seed selection. Some other questions were included, such as the role and participation of women in cotton cultivation in each of the operation phases as detailed in the instrument "Map of Activities" developed for the plenary session with farmers.

The interviews with regional association managers were planned around 25 questions, the majority of which were open-ended. Interestingly, one of the associations interviewed in Cereté was headed by women. Most of the questions explored the position and actual procedures that these managers and associations have in place regarding the use and distribution of transgenic seeds, as well as their perceptions regarding these varieties. Another set of questions explored these managers' opinions regarding women's credit management and possible advantages in the use of GM seeds.

6. RESULTS FOR SURVEY, FOCUS GROUPS, AND INTERVIEWS

Survey

The only quantitative instrument implemented was a short one-page survey that was administered to farmers who participated in the workshops. As stated in the previous section, these farmers cannot be considered representative of Colombian cotton producers, or even the municipalities of Cereté and El Espinal. The one-page survey was administered to get a general overview of the main characteristics of participant farmers. Table 6.1 summarizes the main variables in this survey, with results aggregated for participants of Cereté and El Espinal. Detailed results of these surveys can be found in Appendix Table A.1.

Table 6.1—Main characteristics of farm participants

	Female			Male			Total
Variable	Conventional	Transgenic	Total	Conventional	Transgenic	Total	
Number	9	9	18	10	7	17	35
Head of household							
Yes	4	2	6	10	7	17	23
No	5	7	12	0	0	0	12
Marital status							
Has partner	5	8	13	10	6	16	29
Single/widow	4	1	5	0	1	1	6
Age (average)	49.1	48.4	48.8	48.9		46.9	47.9
Education (years)	8.0	10.0	9.2	8.0		8.8	9.0
Works on farm						44.0	
Full-time	6	3	9	8	10.0	13	22
Occasionally	1	4	5	2		3	8
N.R.	2	2	4		5	1	5
Works off farm						1	
No	5	5	10	5	1	10	20
Yes	3	1	4	5		7	11
N.R.	1	3	4		5		4
Cotton experience (years)	6.3	5.5	5.9	10.6		2	8.5
Land tenure							
Own	7	4	11	7	10.3	11	22
Rent	2	5	7	3		6	13
Yield (last season, ton/hectare)	3.5	2.7	3.1	3.3		4	3.0
						3	
						2.3	

Source: Authors' results.

Cotton Activities Map

To understand the role of women in the production cycle of cotton the cost structure of the IFPRI-CONALGODÓN survey, developed initially by CONALGODÓN was used. Each phase of the cotton production was identified, from plot selection to credit cancellation at the end of the season when farmers receive their net payment for their product. In this process the differences between men's and women's tasks were identified. This exercise was adjusted for Cereté from the experience of El Espinal. In Cereté the exercise was expanded to explore the differences that the technical change has brought in specific crop practices, and how and if those changes in practices have affected men and women in a differential way. Table 6.2 summarizes the main results of this exercise. The activities listed in this table detail how females participate or supervise, and how they compare with their male counterparts. Participation in this table is understood as performing the activity, as opposed to supervising, which is listed separately.

Table 6.2—Participation of female and male participants in cotton activities (in percentage by group)

Activity	Role	Female/GM		Female/Conv.		Male/GM		Male/Conv.	
		El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté
Planting decision	Participates	20	33.3	SH: 100	40	66.7 / SH: 33.3	100	100	16.7 / S: 50
Credit application	Participates	100	100	100	100	100	80 / S:20	100	83.3 / S: 16.7
Land preparation									
Plow/rake/level	Supervises	40				100		100	
Cincelada	Participates	*	100	*	60	*	100	*	100
Crop registration									
Select technical assistant (TA)	Participates	80	50	100	40	100	100	100	83.3
Individual TA	Hires one		100		40		100		50
Seed planting	Participates		40		42.8 / S: 28.6		100		100
	Supervises	40	HH: 20		HH: 14.3	100	33.3	100	66.7 / S: 16.7
Planting, replanting, and thinning									
Thinning and furrow distancing	Participates				W: 14.3 / HH: 57.1		W: 33.3		HH: 50 / W: 50
	Supervises	40		100	28.6	100	50	100	83.3
Soil analysis	Participates	20	TA+HH: 20			66.67	16.7		
Fertilizing									
First fertilizer application	Participates				W: 14.3		W: 33.3		W: 33.3
	Supervises	40		66.67	14.3	100	33.3 HH: 16.7	100	83.3
Leaf fertilization	Participates	100	100	100		100	W: 50	100	33.3
	Supervises	40		66.67	14.3	100	50	100	83.3

Table 6.2—Continued

Activity	Role	Female/GM		Female/Conv.		Male/GM		Male/Conv.	
		El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté
Manual weeding									
Weed control	Participates	60	100				W: 33.3		33.3
	Supervises	40		66.67	14.3	100	50	100	83.3
Pest management									
Pest monitoring	Supervises	100	20		50	TA: 100	TA: 100	TA: 100	50
Insecticide application	Supervises	60		66.67		100	66.7	4	83.3
Picking up structures	Participates		75		50		100		75
Disease control	Supervises	TA: 40		66.67	100	TA: 100	100	TA: 100	100
Regulation of growth and work Prior to harvest									
Defoliant application	Supervises	40		66.67		100	66.7	100	33.3
Vine removal	Supervises	40		66.67	14.3	100	66.7	100	83.3
Trimming	Participates	W: 40		W: 100		100		100	
	Supervises	40		66.67		100		100	16.7 / HH: 16.7
Harvest									
Prepares materials	Participates	20		HH: 66.7 / OW: 33.3	42.8	33.3 / S: 66.7	100	50 / S: 25	83.3
Hires daily laborers	Participates	40			66.7	100	83.3	100	
	Supervises	40 / S: 40 / HH: 20		S: 33.3		100		100	
Advance payment	Supervises	100	100	100	100	100	83.3	100	83.3
Money management	Participates	60		66.7		100		100	

Table 6.2—Continued

Activity	Role	Female/GM		Female/Conv.		Male/GM		Male/Conv.	
		El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté
Cotton delivery to the association	Participates	60	20	66.7	S: 14.3	100	66.7	100	83.3
Stalk removal	Supervises	40		66.7	14.3	100	66.7	100	83.3
Administrative issues									
Weighs the product	Participates			33.3	14.3		66.7		100
Writing down weight	Participates	20	40	66.7	28.6	66.7	S: 16.7	100	16.7 / S: 16.7
Estimates harvesting cost	Participates	D: 20	80	66.7	28.6 / S: 28.6	100	100	100	100
Accounting	Participates	D: 20		66.7		100		100	
Final payment	Participates	20 / HH: 20 / D: 20	60/ S: 40	66.7	100	100	83.3	100	83.3/ 16.7 Cash

Source: Authors' results.
Notes: Genetically modified (GM); Conventional (Conv.). All shaded areas indicate that there is no participation of women in the specific operation. All others are described as: SH: shared responsibility; S: along with spouse; HH: along with other household member; W: hired labor; D: along with daughter; TA: along with a technical assistant; OW: along with another women.
* This work is observed only in El Espinal.

The first surprising fact of this exercise is that women are involved in many activities in cotton. The initial perception prior to commencement of this project was that the main activities where women were and even could be involved were harvesting and weeding. Table 6.2 shows that the scope of activities performed by females can and have broadened to include almost all activities of cotton production. There is a big exception as women do not spray insecticides. The perception is that insecticides are particularly toxic for women and no woman is involved in this activity. This activity is always delegated to male household members or, in their absence, hired male labor. When interviewed, as well as in the group exercises, women farmers that use Bt cotton were in agreement that not having to spray as frequently was one of the most advantageous benefits of the technology, not only because it meant less need to hire labor, but particularly because it meant less time spent in finding and supervising male labor.

The high cost of transgenic seed has brought changes in several practices for all farmers. The first is the amount of seed planted by hectare. Before the introduction of transgenic seeds to Colombia, farmers planted 15–17 kilograms per hectare. With the introduction of transgenic seed that cost three times more than conventional seeds, these densities have been reduced to 10–12 kilograms per hectare. Initially these changes were observed in transgenic seed plantings, but this alteration has spillover to conventional seeds, although the lower densities are still observed for transgenic seeds. Farmers with resources and access to rented planting machines are, of course, more successful in achieving these lower densities. To what extent small-scale farmers and particularly women who plant transgenic varieties have equal access to these planting machines is not clear, but the evidence from the workshop suggests that access to planting machines is limited.

Another activity that only farmers that plant transgenic seeds perform is soil analysis, which TAs recommends for all cases and farmers. A possible explanation for this is that given that transgenic seeds are three times more expensive than conventional seeds, farmers pay more attention to soil quality and management to secure their investment. Another difference between transgenic and conventional crop management is farmers are more likely to hire a private TA in addition to the one required by the association. All farmers that planted transgenic varieties in Cereté hired private TAs. These private assistants would pay more visits to the farmers and give more personalized attention in contrast to the TA required by the association. The TA plays a more supervisory role on behalf of the association. Their role is to ensure that the credit extended to each farmer is used according to the association's best interests, which are not necessarily aligned in all cases with those of the farmers. Women in El Espinal said that they follow their TAs' instructions. TAs also expressed that female farmers, relative to male farmers, were more likely to follow their advice. For herbicide-tolerant (HT) varieties there has been an important change in weed control as the manual removal of weeds has been reduced to a minimum, which in turn has meant fewer female laborers hired for this arduous activity. The application of glyphosate for these HT varieties is done mainly by males, as it is customary for women to stay away from pesticides.

Another surprise that came from this exercise is all of the other *invisible* activities that women perform during the cotton-production process. These activities were identified during the exercise but had not been included in the IFPRI-CONALGODÓN 2007–08 survey. The men and particularly women that participated in this mapping exercise pinpointed the importance of these activities. This set of identified activities included: requesting advance payment from the association, delivering cotton to association for ginning, and all of the administrative activities listed in Table 6.2. Although a high participation of women in these activities was found, there were no substantial differences between women that plant transgenic and those who plant conventional varieties.

From the above observations, recommendations and suggestions of possible research issues to be explored or taken into account in future work can be made:

- To explore the gender roles in cotton (or any other crop) it is necessary to disaggregate and map by operation each activity that is performed and annotate what activities are done by males and females, paying attention to the administrative activities that can be easily overlooked and undervalued.
- The above exercise needs to be extended to include the changes in activities for farmers and possible differences between males and females that the cultivation of transgenic crops has brought.
- To assess changes that the cultivation of transgenic crops has brought, it is necessary to look in detail at each activity. What this exercise has shown is that it is not possible to make broad generalizations.

Variety Preferences Matrix

Whereas the above exercise of mapping the specific cotton activities was done in the plenary session, for the variety preference matrix the group of participants was broken down into four groups by gender (female/male) and type of variety planted (GM/conventional) to discuss farmers' specific variety preferences. Tables 6.3 to 6.6 summarize the results of the discussion that each group had.

Table 6.3—Matrix of variety preferences, El Espinal

		Female						Male					
	Assigned value for Conv.	Grouped by type of variety planted						Grouped by type of variety planted					
		GM	Conv.	GM	Conv.	GM	Conv.	GM	Conv.	GM	Conv.	GM	Conv.
		Opinion about variety with respect to assigned value for conventional						Opinion about variety with respect to assigned value for conventional					
Criteria		IR		HT		HT & IR		IR		HT		HT & IR	
Costs	10	8	*	8	7	8	4	12	7	12	8	13	6
Wages	10	7	*	5	6	5	4	9	10	9	9	8	9
Time spent	10	8	*	5	7	5	7	9	7	9	6	8	5
Field yield	10	12	*	6	10	8	10	na	12	na	14	12-11	10
Fiber quality	10	10	*	11	15	11	15	9.5	11	9.5	15	9	13
Profits	10	10	*	5	14	12	17	10	12	10	17	10	15

Source: Author's compilation based on survey results.
Notes: *This variety was not evaluated for this group, as women that planted conventional varieties had no experience with this GM variety.
Conv.: conventional variety; GM: genetically engineered variety; HT: herbicide-tolerant variety; IR: insect-resistant variety.

Table 6.4—Variety preferred, El Espinal

	Females				Males			
	Variety preferred							
	Conv.	IR	HT	HT & IR	Conv.	IR	HT	HT & IR
Planting conventional				**3**	**1**		**4**	
Planting GM	**2**			**5**	**1**			**2**

Source: Author's compilation based on survey results.
Notes: Conv.: conventional variety; GM: genetically engineered variety; HT: herbicide-tolerant variety; IR: insect-resistant variety.

Table 6.5—Matrix of variety preferences, Cereté

	Value assigned	Female						Male					
		Grouped by type of variety planted						Grouped by type of variety planted					
		GM	Conv.[2]	GM	Conv.[2/]	GM	Conv.[2/]	GM	Conv.	GM	Conv.	GM	Conv.
		Opinion about variety with respect to assigned value for conventional						Opinion about variety with respect to assigned value for conventional					
Criteria	**Conv.**	**IR**		**HT**		**HT & IR**		**IR**		**HT**		**HT & IR**	
Costs	10	8	*10*	7	*10*	5	*10*	11	10	9	10	8	7
Wages	10	8	*5*	6	*5*	4	*5*	9	7	7	6	5	5
Time spent	10	6	*10*	6	*10*	4	*10*	9	8	9	7	5	7
Field yield	10	11	*15-5*	12-6	*15—5*	12—6	*15—5*	11	12	8	9	10	9
Fiber quality1/	37% -10	39.5%	*15*	39% 45%	*15*	41%	*15*	11	8	9	8	12	6
Profits	10	11-12	*15*	8-9	*15*	8-9	*15*	10	12-8	10	11-7	10	6

Source: Author's compilation based on survey results.
Notes:1/ Fiber quality, as all other criteria, was initially assigned a value of 10. Some of the groups were more comfortable assigning a yield value to fiber, as it is clear to them in terms of percentage. So in those cases values were compared to a yield fiber for conventional cotton of 37 percent.
2/ Female farmers that plant conventional cotton compared conventional versus transgenic in general with no distinction by variety (HT, IR, or HT & IR), so all values in these columns are the same.
Conv.: conventional variety; GM: genetically engineered variety; HT: herbicide-tolerant variety; IR: insect-resistant variety.

Table 6.6—Variety preferred, Cereté

	Females				Males			
	Variety preferred							
	Conv.	IR	HT	GM	Conv.	IR	HT	GM
Planting conventional				5	1		4	14
Planting GM	2	1	1	1		1		2

Source: Author's compilation based on survey results.
Conv.: conventional variety; GM: genetically engineered variety; HT: herbicide-tolerant variety; IR: insect-resistant variety.

The results of this exercise show that there are differences between the two regions and within the region among male and female farmers. Women in El Espinal, regardless of variety planted, have the opinion that all transgenic varieties compared to conventional ones have lower costs, require less number of daily wages, and are less demanding in terms of time management. In contrast, male farmers in El Espinal who plant transgenic varieties were vocal about the high cost of transgenic varieties but at the same time acknowledged that these varieties will produce higher yields. Female farmers who only plant transgenic varieties ranked yields for IR varieties better than those who plant conventional. The criteria that were better ranked in comparison to the assigned 10 to conventional were *wages* and *time spent* managing their plot. Although not detailed in this table women, who planted transgenic crops, saw this as the best characteristic of transgenic varieties as it freed time that they could devote to other domestic and productive activities on their farm and in their household. Both female and male farmers in El Espinal favored transgenic varieties in terms of the profits that these varieties would yield.

In Cereté the criteria of wages and time spent were also ranked below the value assigned for conventional varieties, with the exception of female farmers who planted conventional varieties. This group of women said they didn't have any opinion of specific GM varieties. In this region both female and male farmers made a distinction of the two previous seasons, as the region was hit with substantial losses in the year 2008. Farmers' perception is that the transgenic varieties planted in that season were not good, and the reason for the poor results that year are yet to be assessed as many factors could have played a role, from the poor weather conditions to lack of information to erroneous information in the hand of farmers to inadequate germplasm. For these reason two values are presented in Table 6.4, one for each of the previous seasons.

From the above observations the following recommendation and suggestions of possible research issues to be explored or taken into account in future work are presented:

- Female farmers appear to prefer GM varieties that require less hired labor and time management. Men tend to favor varieties that yield higher profits.
- Lack of information is one of the main limitations and it appears to be more prevalent for women as they have limited sources of information. In Colombia, women's main and basically only source of information is the scattered visits from TAs.

Priority Action Matrix

This exercise was also done with four groups of farmers, two for females and two for males according to the variety planted (transgenic or conventional). The first part of this exercise was for farmers to identify the main problems that the technology has brought. The following are the categories of problems identified by all farmers:

- Lack of or poor information—Information
- High cost of the technology—Cost
- New diseases and pests—Secondary pests

- Availability of GM and non-GM varieties—Availability
- Adaptability of GM varieties—Adaptability

Table 6.7 presents a summary of this exercise. The exercise was planned as an open-ended discussion among all farmers and the groups' perceptions and opinions were recorded by the facilitator. Neither the researcher nor the facilitator of each group volunteered or suggested their perceptions, as the idea was to collect the opinions of each group without interference or feedback from anyone else.

Table 6.7—Technology change problems—ranked in terms of importance (1 = most important)

	Female				Male			
	GM		Conv.		GM		Conv.	
Problem	El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté	El Espinal	Cereté
Information and follow-up	1,5	2	2	2	1,4	3		2
Cost		3			2	1	2	1
Secondary pests		1	1			2		
Availability		4	4	1	3	1		
Adaptability	4							4
Other	2,3		3			1,3	1,3	3

Source: Authors' results.
Notes: Conv.: conventional variety; GM: any genetically modified variety.

The interesting part of this exercise was that despite being an open-ended discussion most farmers identified basically the same problems, particularly those that referred to lack of or poor information and seed availability, be it transgenic or conventional seed. In the past season availability was an important issue for small farmers in the coastal region where farmers couldn't find conventional seeds. In previous seasons there was scarcity also for transgenic varieties.

What all farmers want to have from private seed companies, associations, and technology owners is more and better information, more frequently, and available in different media. They also expect that this information be made available to TAs so they can pass it on to them. From Table 6.5, it appears that the lack of information is a more prevalent problem for women farmers, as women ranked it almost always at the top of their list. At the same time it is interesting to see from Table 6.5 that despite transgenic seeds being three times more expensive than conventional seeds, this issue was identified as an important one by all men and was picked up only by women that plant transgenic cotton in Cereté. The other three groups never mentioned it.

Personal Interviews with Farmers

Of the 35 farmers in this sample, the group did individual interviews with 13 farmers to learn more about specific points identified in the mapping and other group exercises described above. Additional points that these interviews explored were individual farmer's perceptions regarding any discrimination against women in credit and seed availability and their opinion regarding changes in tasks performed by men and women brought on by the introduction of transgenic seeds. Both men and women interviewed agreed that there was no differentiated treatment of men or women when it came to credit application or seed availability. According to those interviewed, associations will extend credit to all farmers that can provide the necessary documentation and fulfill their asset or cosigner requirements. Whether female farmers have equal capacity to fulfill these requirements is an open question as a wife would not appear as owner of household assets titled solely under her husband's name. Regarding seed availability, both female and male farmers perceived that it was not adequate as sometimes they ended up planting what was available at the association's and not their initial preferred variety. It appears that farmers with more resources tended to have their choice fulfilled first, whereas smallholder farmers were left to adjust their requirements and obtain varieties that were still available.

Of all the advantages of transgenic varieties that farmers talked about, the main theme appeared to be that transgenic varieties required less hired labor and less time invested in managing the crop. At the same time some women and men farmers saw the former as a disadvantage as less hired labor would create more unemployment. A point noted only by women as an advantage of GM varieties was the peace of mind that these varieties have brought to them. Knowing that their plots would not be attacked by bollworms was qualified as priceless by some of the women.

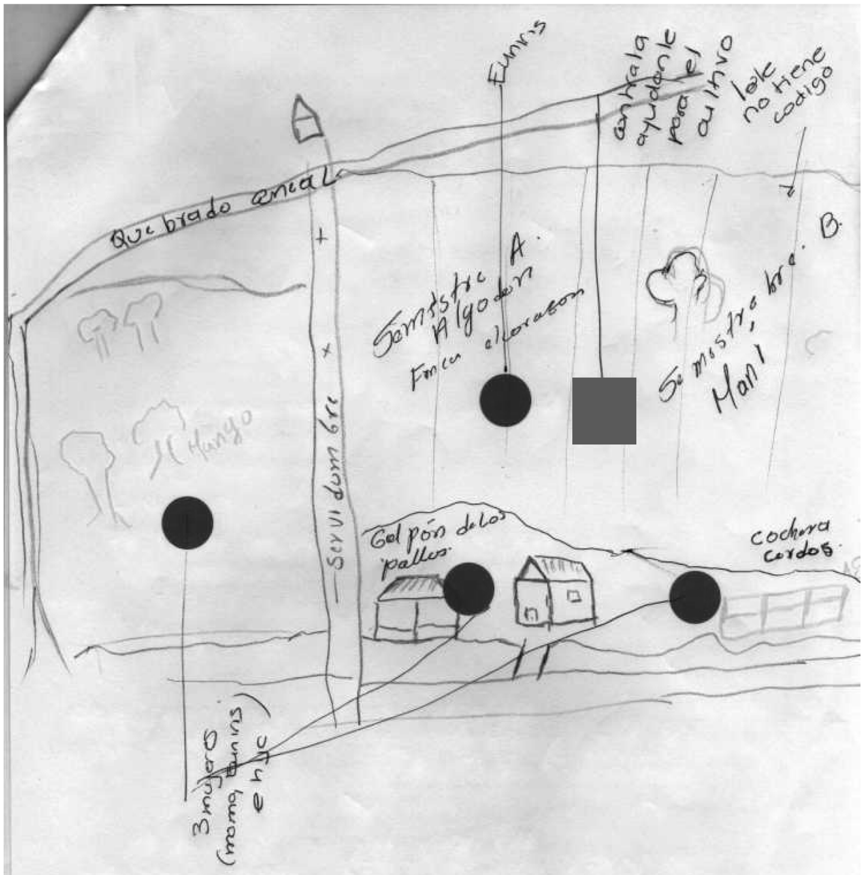
Regarding the change in tasks performed by men and women brought by the introduction of transgenic seeds, all women and more than half of the men interviewed identified changes. The factor most mentioned was the drop in number of hired labor and time spent managing the crop. Men and women identified some activities that are no longer performed or are done differently with the use of GM varieties, as compared to conventional varieties. The net effect of changes in tasks performed by men and women depended on the gender of the person performing or hired to perform the task and is a research question that needs to be examined further.

Farm Map: All 17 interviewed farmers were asked to draw a map of their farm or plot. Men appeared to be less keen in making such a map, and women were more willing to add more details. This is a useful exercise in the sense that it made farmers and researchers visualize the multiple tasks that women play in a farm household, which sometimes was surprising even to the farmer drawing the map.

A good example of this exercise is the map drawn by one of the female farmers, a single mother that lives with her elderly parents and is in charge of all tasks in her household from food preparation to managing and working in the field. She is not the landowner and she turns in all profits to her father for an even distribution among all family members, including her absentee brothers and sisters. Figure 6.1 is the drawing that this female farmer made. Stickers in this drawing represent who is in charge of the specific activity and the shape represents the gender of that person, circle for women, square for men. She is in charge of the fieldwork and hires men laborers for the application of insecticides. Along with her mother and daughter, she works also in the mango fields and keeps the pigs and chickens that the family has for sale and self-consumption.

Of the 13 women in Cereté and El Espinal that drew a farm map, there was a clear difference among women that were single and those who had a partner. Women who are single (not necessarily head of household) are the ones that devote the most time to the crop operation, whereas women who have a partner will rely more on help from their male partner.

Figure 6.1—Example of maps drawn by interviewed farmers



Source: Participant drawing.

Information Flow between Technology Owners and TAs

TAs from both Cereté and El Espinal agreed that Monsanto and more recently Bayer representatives give them information regarding the GM varieties. The information is given at the beginning of each season, before farmers have planted. Usually this information is limited to a one-day meeting convened by the Monsanto or Bayer representatives to showcase the GM varieties that will be available during the season. During that day and throughout the season these reps will supply written materials. Most of the TAs considered that this information is not enough as it is not detailed and they are not really trained in the specific management of these varieties. It was only after the poor results with one of the HT varieties in 2008 that Monsanto, under pressure from farmers and associations organized a three-day training meeting with international experts, paid by Monsanto, and selected TAs.

The poor results of the HT variety were, in the opinion of TAs of Cereté, due to incorrect information given by Monsanto. According to the TAs, the timing and dosage of glyphosate that Monsanto representatives initially gave were incorrect. Overall the perception of all TAs that participated in this workshop is that the information given by Monsanto reps is insufficient and it would be desirable that the information about these varieties was widely available during all seasons to all TAs.

Information Flow between TAs and Farmers

The exercise of mapping the information flow from TAs to farmers was done first in El Espinal and later was redesigned for Cereté to include more detailed information. Table 6.8 summarizes the results for El Espinal, and Tables 6.9 and 6.10 show results for Cereté, where a more specific exercise was developed to take into account differences by variety type and gender.

Table 6.8—Information flow matrix between TAs and farmers, El Espinal

Crop operation	How much time (%) do you assist farmers in _____?	What media do you use to give advice _____?	How much (%) do men/women follow your advice regarding ____?	
			Male	Female
1. How much seed to plant per hectare	7	Plot visits, cell phone calls, plot record from visits	100	100
2. Seed selection	6		100	100
3. Planting	10		100	100
4. Soil fertilizer selection and application	10		70	95
5. Weed control	11		100	100
6. Leaf fertilizer selection and application	7		80	95
7. Insecticide selection and application	18		80	95
8. Disease management	11		90	90
9. Growing regulators and preharvest activities	7		100	100
10. Assistance during harvest	2		100	100
11. Stalk destruction	14		100	100

Source: Authors' results.
Notes: Table 6.8 shows that cotton operations, where TAs in El Espinal, spend proportionately more time giving advice regarding the use of insecticides and managing weeds and diseases. They think most of the time male and female farmers fully follow their advice, and in the cases where farmers' approval isn't 100 percent, it is mainly male farmers who will disregard their advice. From the interviews that follow this exercise, TAs have what may appear contradictory opinions regarding the way women access information and how they manage. Many of the interviewed TAs would say that women follow the advice given by their TA as women are more careful with the way they manage their plot. On the other hand, TAs also say that the reason female farmers tend to follow their advice is mainly explained by female farmers being less informed than male farmers, because women lack the experience or the time required to look for such information. For this reason it is the opinion of the TAs that female farmers will plant the variety that their TA suggests, particularly if they are the ones that manage their plots. This assessment, of course, needs further verification not only because these, as all others, are perceptions of this particular group of farmers, but also because most of these TAs do not give technical assistance to female farmers.

The exercise done in El Espinal was interesting as it showed TA opinions and perceptions regarding the time and use of information given to farmers, but it failed to capture any potential differences brought by the introduction of GM varieties. For this reason the exercise was changed when it was applied to Cereté. In this region explicit inquiries were made about these differences, both about the time devoted to each operation according to variety and the uptake of TA advice by type of farmer. Table 6.9 summarizes the results for the time spent by type of variety planted. It shows that there are, in fact, differences.

Table 6.9—Information flow matrix between TAs and farmers by variety, Cereté

Crop operation	How much time (%) do you assist farmers in _____? Conventional	GM	What media do you use to give advice _____?
1. How much seed to plant per hectare	1	1	Plot visits, plot record from visits
2. Seed selection	1	1	
3. Planting	1	1	
4. Soil fertilizer selection and application	10	10	
5. Weed control	10	5	
6. Leaf fertilizer selection and application	5	5	
7. Insecticide selection and application	45	30	
8. Disease management	15	30	
9. Growing regulators and preharvest activities	5	10	
10. Assistance during harvest	5	5	
11. Stalk destruction	2	2	
Total time (%)	100	100	

Source: Authors' results.

TAs say that compared to conventional plots they spend less time in GM plots giving advice regarding weed control and insect control. These findings are in a sense logical as IR and HT varieties ideally will reduce the number of insecticide applications and simplify weed management. What is surprising is that all TAs agreed that transgenic varieties demand more attention from them in the areas of disease management, use of regulators, and preharvest activities.

Table 6.10 on how farmers in Cereté follow TA advice is disaggregated by operation, variety planted, and gender. The table shows, as it did in El Espinal, that in most cases their advice, and their opinion, is fully followed. The *perfect score* goes to female farmers that plant GM varieties, as they follow their TAs advice regarding every operation. On the other hand, the least agreeable farmers are men that plant conventional varieties.

These exercises show that women tend to follow the TAs advice in higher proportion than men. Some TAs think this better reception from women is because women are overall more agreeable and as cotton farmers have much less experience with cotton. Other TAs think that they tend to follow their advice because women are more careful with the management of their financial resources and for that reason will pay more attention to their specific advice as they want to secure the best return possible on their investment. This last explanation seems to be more in line with the perception of women farmers. What was clear is that women have, aside from their TAs, a limited circle of people from whom to get advice. Although it is possible for male farmers to reach out to other farmers, as neighbors, friends, or acquaintances, women farmers have a limited number of socially acceptable opportunities to exchange information with other farmers.

Table 6.10—Information flow matrix between TAs and farmers by gender, Cereté

	How much of your advice (as percent) do men/women farmers follow regarding ____?			
Crop operation	**Male/Conv.**	**Male/GM**	**Female/Conv.**	**Female/GM**
1. How much seed to plant per hectare	90–100	100	90–100	100
2. Seed selection	100	100	100	100
3. Planting	90–100	100	100	100
4. Soil fertilizer selection and application	60	65	100	100
5. Weed control	100	100	100	100
6. Leaf fertilizer selection and application	50	50	100	100
7. Insecticide selection and application	100	100	100	100
8. Disease management	100	100	100	100
9. Growing regulators and preharvest activities	50	50	100	100
10. Assistance during harvest	30	30	100	100
11. Stalk destruction	30	30	30–40	100

Source: Authors' results.
Conv.: conventional variety; GM: any genetically modified variety.

7. FINDINGS AND CONCLUSION

Findings—Issues Identified

The lack or incomplete information in the hands of cotton producers in Colombia has been documented. The literature about the impact of GM crops in developing economies has also identified information as one key element in the success of GM adoption (see Tripp 2009 and Gouse et al. 2005, for example.) Despite this, differences by gender regarding information have not been studied in the literature. The results of this workshop indicate that women see information as key to handling GM varieties and are, relative to men, more willing to put additional effort into following directions about how to adjust their practices. This is a perception shared by technical assistants (TAs) and association managers. At the same time this perception seems to be based on women farmers having had less access to information and also perhaps having less experience.

The reason why women have less access to information compared to men is not because the information has been targeted to men but is related to women having a wider array of responsibilities that interfere with their chances to attend meetings or interact with other farmers. At the same time, their social circles and their leisure time is quite limited, making it difficult for them to meet other female farmers to talk about their experience with cotton. This is probably one of the reasons why female farmers, compared to men, tend to pay more attention to their TA's advice. This would seem to suggest that female farmers are potentially better adopters than men, as they are keener to adjust their practices than men, who appear to place more value on their previous experience with cotton and other farmers' advice.

Although GM seed is substantially more expensive than conventional seed, the perception of both women and men farmers is that GM cotton is advantageous, even among those who do not adopt. The difference is that women see the advantage as a way to save money in some critical activities that would otherwise require them to hire and supervise men, particularly for the application of insecticides and other chemicals. Both men and women see this technology as beneficial, but for women the critical factor is saving labor whereas for men it is the better yields.

Women and men farmers believe that they save time with HT technologies. The difference is what they do with that time. Women will tend to use their free time in other productive activities, and men might see it as a window for leisure.

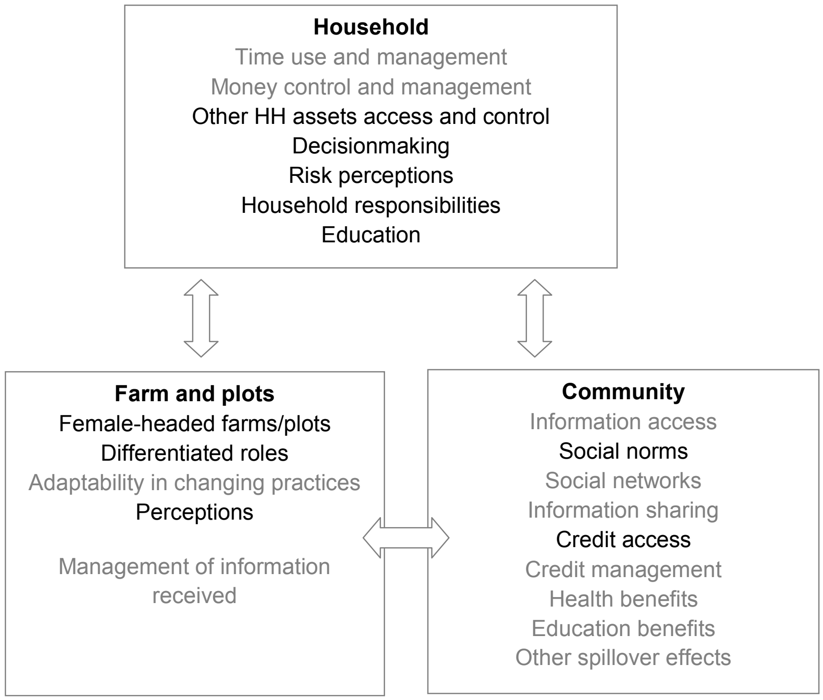
In the opinion of some association managers and TAs, women are more judicious about handling their credit lines. There appears to be a practice among men to divert credit resources to other activities (women and alcohol). Female farmers, on the other hand, will tend to use their credit line in a more conservative way.

So far women who plant GM varieties tend to have leadership characteristics and have more years of education, but the benefits that these women adopters get from these varieties could reach other female farmers, if information were to become available to them.

The exercise mapping of all cotton activities showed that women that manage their plots participate in almost all production activities. Overall, aside from harvesting and weeding, the traditional activities in which women have been involved; women also participate in other less traditional operations such as leaf fertilization. It also showed that overall women play an important role in supporting cotton activity for their spouses and partners—securing credit lines for them. Aside from this activity, women also play an important role in other administrative operations that usually remain invisible, in the sense that they are not formally accounted for as a cost of production.

Figure 7.1 is a schematic way of presenting the different issues identified by this project.

Figure 7.1—Identifying gender-differentiated issues that may affect adoption and impact of GM crops



Source: Author's creation.

Conclusion

This paper explored the differences in perceptions and experiences of men and women in the main cotton regions of Colombia regarding GM cotton. For this study, a qualitative methodology was developed to facilitate the discussion among farmers, regional cotton association managers, and TAs. This work has shown that the traditional assessment that women are and cannot be cotton farmers needs to be revised. Although there are few female cotton farmers, this study showed that cotton is a viable opportunity for women to participate in growing profitable cash crops. Transgenic varieties appear to be attractive for women farmers as a way to save in labor costs, particularly those associated with traditionally male activities, such as spraying insecticides. Women, as compared to men, also appear to place more value on the peace of mind that these varieties give them, such as protecting crops from specific insects. Easier management of GM crops, as perceived by all farmers, appears to be particularly important to women given their more restrictive time demands.

This study advances the effort to make visible the strengths and contributions of women as farmers and, for the first time in Colombia, shows the potential of women as successful cotton farmers. Both CONALGODÓN and regional cotton associations now have an increased awareness of this opportunity. Addressing gender differences in access to information, seeds, credit, and services can benefit women and their families and be good business for cotton associations.

The methodology developed in this study is a first step toward understanding the differences (or lack of them) between men's and women's perceptions and experiences with GM cotton. The study helped to develop insights that apply to this specific group of people and time, but that are expected to help guide future qualitative and quantitative research on the use and adoption of GM crops.

There is ample space to move forward, but the methodological approach developed in this study is a first strategy for understanding complexities associated with GM cotton cultivation and the role that women and men have on guaranteeing the success of this crop.

APPENDIX: DETAILS OF SURVEY RESULTS AND IDENTIFICATION OF STUDY LIMITATIONS

Farmers Main Characteristics

Table A.1—Survey results: Farmers main characteristics

		Cereté			El Espinal			Total
		Female	Male	All	Female	Male	All	All
Sample (n)	Conventional	6	7	13	3	3	6	19
	Transgenic	4	4	8	5	3	8	16
	Total	10	11	21	8	6	14	35
Age (average)	Conventional	51	52	52	45	41	43	49
	Transgenic	43	43	43	53	46	51	47
	Total	48	49	48	50	43	47	48
Education (years)	Conventional	8	9	9	7	6	6	8
	Transgenic	11	11	11	9	6	8	10
	Total	9	10	9	8	6	7	9
No of children	Conventional	4	3	3	3	2	2	3
	Transgenic	3	3	3	3	1	2	3
	Total	4	3	3	3	2	2	3
Cotton experience (years)	Conventional	7	13	10	6	5	5	9
	Transgenic	5	9	7	11	12	12	9
	Total	6	11	9	10	9	9	9
Plot size (hectares)	Conventional	3.9	3.7	3.8	1.8	2.1	2.0	3.2
	Transgenic	4.1	4.9	4.5	11.3	6.6	9.6	7.0
	Total	4.0	4.2	4.1	7.8	4.4	6.3	5.0
Yield (hectares)	Conventional	3.6	3.5	3.5	2.7	2.8	2.7	3.3
	Transgenic	1.9	2.2	2.0	2.9	2.4	2.6	2.3
	Total	2.8	3.0	2.9	2.8	2.6	2.7	2.8
Work on farm	Conventional	6	7	13	3	3	6	19
	Full-time	3	6	9	3	2	5	14
	No	2		2				2
	Occasionally	1	1	2		1	1	3
	Transgenic	4	4	8	5	3	8	16
	Full-time	1	2	3	2	3	5	8
	No	2	1	3				3
	Occasionally	1	1	2	3		3	5
Work off farm	Conventional	6	7	13	3	3	6	19
	No	3	5	8	3		3	11
	Yes	3	2	5		3	3	8
	Transgenic	4	4	8	5	3	8	16
	No	3	2	5	5	3	8	13
	Yes	1	2	3				3

Table A.1—Continued

		Cereté			El Espinal			Total
		Female	Male	All	Female	Male	All	All
Marital status	Conventional	6	7	13	3	3	6	19
	Married	2	2	4		3	3	7
	Single	2		2	1		1	3
	Unmarried partner	2	5	7	1		1	8
	Widow				1		1	1
	Transgenic	4	4	8	5	3	8	16
	Married	4	2	6	3	1	4	10
	Single				1	1	2	2
	Unmarried partner		2	2	1	1	2	4
Land tenure	Conventional	6	7	13	3	3	6	19
	Own	5	7	12	2		2	14
	Rent	1		1	1	3	4	5
	Transgenic	4	4	8	5	3	8	16
	Own	1	2	3	3	2	5	8
	Rent	3	2	5	2	1	3	8

Source: Study survey results.

Logistic and Methodological Limitations

Logistical Limitation

The two main limitations in the implementation of the project were related to the limited budget and the restrictions in the participation of women farmers. Despite the Universidad de Los Andes suggesting a two-day meeting per site as the optimal time to conduct the fieldwork with farmers and other stakeholders, the team had to limit it to a day per site due to budget constraints. In addition, securing the participation of female farmers in a two-day workshop would have been challenging. The organization of the workshop showed that female farmers, compared to male participants, had more constraints with managing their time. Men were more willing to commit their time to participate in a daylong workshop; women were more reluctant due to their household commitments. Cooking and taking care of children, elderly, or sick relatives are day-to-day activities that are not easy to delegate. Time constraints for women appear to be far more limiting than for men.

Despite the focus groups being a daylong activity and planned during a time that was perceived as *low* season regarding agricultural activity, there were several women who had confirmed their participation and had to cancel at the last minute. The reasons given by those women were all related to household/family commitments—babysitting, taking care of an elderly or sick parent/relative, or tending to other housework. Many of the attending women stated that for them to be able to attend, they had to make earlier arrangements, such as asking a neighbor for help or preparing lunch in advance. None of the men seemed to have any similar constraints.

Transportation was another difference among men and women participants worth noting. To guarantee that all confirmed participants showed up at the convened time, CONALGODÓN arranged transportation for all participants. A driver with a van was hired to pick up participants from a location close to their place of residence. Although this transportation was offered to both men and women, only women used this service. Most of the men arrived using their own means of transportation, opting to take CONALGODÓN compensation money to cover for the equivalent cost of public transportation.

Methodological Advantages and Limitations

The Universidad de Los Andes team that designed the instruments used in this study, summarized in Table A.2 the advantages and limitations of each of these instruments.

Table A.2—Advantages and limitations of methods and tools used

Method	Tool	Advantages	Limitations
Qualitative	Map of cotton activities	It gives an overview of the role that men and women have in cotton cultivation, clarifying responsibilities, and decisionmaking. The analysis identifies differences between the cultivation of conventional and transgenic seeds and highlights the role of women within the crop.	At the end of the exercise, the role of each group (men and women planting GM or conventional crops) within the crop is not visually clear, which does not allow generating other opportunities for discussion among participants..
	Variety preferences matrix	It allows identifying and learning about women and men's variety selection criteria and preferences. Similarly, it provides a direct understanding of the benefits and disadvantages of GM varieties identified by farmers using these varieties	The criteria weighting may be biased toward the most recent season results, or be affected by preferences of the more outspoken person in the group, or the person who has better knowledge about the technology.
	Priority action matrix	It allows identifying problems associated with technological change, from the point of view of farmers—men and women—and the familiarity that each group has about the new technology. The information collected reflects the experience of participants, who can easily identify weaknesses and strengths in the adoption of this new technology.	The tool does not allow identifying problems associated directly with farmers' management and use of technology. It does not identify the problems resulting from misuse or misapplication of the technology on the field, which may be related to traditional crop management practices.
	Information matrix from GM seed developer /distributor to technical assistant (TA)	It allows knowing the degree of information that TAs have regarding genetically modified varieties, as well as gaps or breaks in the flow of information.	The exercise can be skewed because of low number of participant TAs who provide assistance to women farmers in the area.
	Information matrix from TAs to farmers	It allows identifying from the view of TAs, how receptive are farmers (men and women) to shifting farming practices as a response to technology transfer. The exercise creates a space for dialogue with TAs that can be useful for understanding the context and for the analysis.	The exercise can be skewed by the low number of TAs who provide assistance to women farmers in the area.
	Interviews	Allows creation of a space for dialogue with the identified key actor and to obtain clear and firsthand information about their role in the cultivation of cotton. It also allows deepening and clarifying doubts concerning the crop with actors who have more knowledge and experience.	The results do not represent the entire community, but provide only a particular and specific vision. That is, results are not representative but explanatory.
Quantitative	One-page survey	It allows more detailed information about farmers that participate in the focus groups.	The results do not represent the entire community, but provide only a particular and specific vision.

Source: Maldonado et al. (2010).

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2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org